IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: **Kazuhiro ABE et al.** Art Unit: **1793**

Application Number: **10/565,121** Examiner: **Yun Qian**

Filed: **January 19, 2006** Confirmation Number: **6145**

For: **PHOTOCATALYST SHEET AND METHOD OF PRODUCING SAME**

Attorney Docket Number: **062015**
Customer Number: **38834**

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Kazuhiro Abe, a citizen of Japan, hereby declare and state the following:

1. I graduated from University of Yamagata, Yamagata-shi and Yonezawa-shi, Yamagata, Japan in 1997 with a Master degree in Engineering.

2. Since 1997, I have been employed by Taiyo Kogyo Corporation of Osaka-shi, Osaka, Japan where my present title is Research Engineer of Material development for Technical Research Center. During my employment therein, I have conducted research and development of membrane materials.

3. I am the author of the following publications:

• 2005 "Removal of NOx for PTFE-coated fabric treated with TiO2 photocatalyst", Research report on membrane structures 2005, The membrane structures association of Japan. (in Japanese)

4. I have read and am familiar with the above-identified patent application as well as the Official Action dated September 9, 2010, in the application.

5. I have read and am familiar with the contents of cited reference, JP 09-207289 to Domoto et al. cited in the Official Actions in the above-identified application.

6. I began studying the development of photocatalyst sheet for film/fabric structure under the guidance of Professor Fujishima of the University of Tokyo and Professor Hashimoto of the University of Tokyo.

7. Professor Fujishima is well known for and respected for being the first to discover the photocatalyst function of TiO_2.

8. Professor Fujishima and Professor Hashimoto are co-inventors of the above-identified patent application.

9. Professor Fujishima and Professor Hashimoto were co-inventors of the cited reference, JP 09-207289 to Domoto et al., and are familiar with the disclosure of Domoto.

10. At that time of invention, there was no known suitable material of fluorocarbon resin for the uppermost layer containing photocatalysts which has a tolerance to the strong redox effects of photocatalysts and also has a thermal weldability of lap joint at the same time.

11. Under the guidance of my supervisor, Dr. Toyoda, I conducted experiments to obtain data for the thermal weldability and antifouling property tested photocatalyst sheets. The object of experiments was to obtain optimum weight % range of photocatalyst of the third fluorocarbon resin (FEP) layer.

12. We explain the results of the experiments. Table 1 shows the evaluation results of thermal weldability and the antifouling property by outdoor exposure of prepared photocatalyst sheets. Test 1 to 6 corresponds to Examples 1 to 6 and Test 7 to 10 corresponds to Comparative Examples 1 to 4.

Thermal weldability was evaluated either by using a test machine on the thermal welded part of the photocatalyst sheets. The test was carried out in such a way that the tested part was peeled off at the rate of 20 mm/min. When the fluorocarbon resin layers were completely melted and the whole resin part was peeled off from the glass fiber substrate, the evaluation is good and indicated by ○, and when the peeling occurred at the boundary of resins, then the result was evaluated as poor and indicated by ×.

As is clear from the Table.1, the thermal weldability was good for Test 1-6 where % by weight of the photocatalyst in the third fluorocarbon resin layer (shortly termed as % by weight of the photocatalyst) was in the range of 10- 60%.

The evaluation of antifouling property by outdoor exposure was carried out by observing the dirtiness of the sheet surface after twelve months outdoor exposure of the sheets of Test 1-10. The sheets without dirt were evaluated as excellent and marked with ○, the sheets with little dirt were evaluated as good and marked with △, and the sheets with dirt were evaluated as poor and marked with ×. Outdoor exposure was carried out on the rooftop of the Center for Space Structures Research (Hirakata city, Osaka) of the present patent applicant.

As is evident from the figure, the antifouling property was excellent for Test 1-6 where % by weight of the photocatalyst in the outermost fluorocarbon resin layer was in the range from

10 to 60%.

By these facts it should be obvious that the excellent thermal weldabilty and excellent antifouling property were achieved in the range from 10 to 60 % by weight of titanium dioxide in the fluorocarbon resin of the third layer.

As for the photocatalyst sheet having the uppermost layer made of PTFE containing photocatalyst such as shown in JP 09-207289, we did not test an evaluation of thermal weldability. Since we have known that the viscosity of PTFE above the melting point is 10^{10}-10^{12}Pa·s, this value was not enough for thermal welding at all and we had imagined easily that the adding of photocatalysts in the outermost fluorocarbon resin layer made of PTFE will deteriorate the welding property such as strength in peeling test. This is a common knowledge for film/fabric structure. These are reasons why we had omitted a test for the photocatalyst sheet such as shown in JP 09-207289.

TABLE 1

Sample	FEP:TiO_2 (Weight Ratio)	Evaluation of Thermal Weldability	Evaluation of Antifouling
Test 1	40 : 60	○	○
Test 2	40 : 60	○	○
Test 3	70 : 30	○	○
Test 4	80 : 20	○	○
Test 5	90 : 10	○	△
Test 6	60 : 40	○	○
Test 7	30 : 70	×	△
Test 8	20 : 80	×	△
Test 9	10 : 90	×	△
Test 10	100 : 0	○	×

13. From the attached experimental results, I have concluded, among other things, that the photocatalyst sheets of tested Test 1 to 6 having the FEP layer as the third layer containing photocatalyst have the good thermal weldability and antifouling property.

The undersigned declares that all statements made herein of his own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that willful false statements may jeopardize the validity of the application or any patent issued thereon.

Kazuhiro Abe

Kazuhiro Abe

Signed this 25 day of January, 2011.